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Aerial Spot-Sprayer Demonstration

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Highlights...

- An aerial spot sprayer allows small areas or individual plants to be treated with minimal damage to nontargeted species.
- A spot sprayer can reduce the amount of man-power needed to complete a job and allow the treatment to be completed when it is most effective.
- The high cost of using an aerial spot sprayer may limit its use to small, high-value areas that are difficult to reach from the ground.

by a 50-foot (15-meter) or 100-foot (30-meter) cable or long line (figure 1). The pilot maneuvers the sprayer into position a few feet above the targeted species and releases the herbicide. The ability to maneuver the sprayer into a precise position close to the ground reduces the chance of herbicide drift and of spraying nontargeted species. Aerial spot-sprayer systems have been successfully used to spray melaleuca in Florida, spartina in the San Francisco Bay Area, thistles in Oregon, Australian tree fern in Hawaii, and phragmites in Washington.

Aerial spraying can be an effective way to control noxious or invasive plant species, especially in remote areas. The problems with aerial spraying using a conventional boom system are that the spray coverage is not limited to the target species and spray can drift outside the target area. An aerial spot-sprayer system can reduce these problems.

Spot-Sprayer Description

An aerial spot-sprayer system is designed to treat individual plants or small areas of target species. A typical system consists of a tank attached directly to the helicopter. A spray ball or other device is suspended beneath the tank



Figure 1—This helicopter is equipped with a spot sprayer.



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Demonstration Target Species

To evaluate the feasibility of using a spot sprayer to treat a difficult-to-access invasive species, an interagency team consisting of personnel from the U.S. Department of the Interior, Bureau of Land Management (BLM) and National Park Service; the Department of Agriculture, Forest Service; Pima County, AZ; and the University of Arizona conducted a demonstration on BLM land at the Ironwood Forest National Monument near Marana, AZ. The target species for the demonstration was buffelgrass (*Cenchrus ciliaris*). Buffelgrass is an invasive species that competes with native vegetation for water and nutrients. It creates a fire-prone environment that can kill or damage native plants and animals. The preferred habitat for buffelgrass is steep and rocky terrain, much of which is unsafe for field crews to access. Current buffelgrass control methods include handpulling and ground-based spraying with herbicides. These methods are slow and physically demanding, and they make it difficult to cover large areas. The window of opportunity for effective herbicide treatment is limited to the summer monsoon season (July through September) when the plant is actively growing.

Test Plot Descriptions

Our objective with this demonstration was to evaluate the spot sprayer in a variety of plot sizes and terrain features that simulate typical buffelgrass infestations. We laid out eight plots:

- A 13-foot by 13-foot (4-meter by 4-meter) plot at the bottom of a canyon
- A 33-foot by 33-foot (10-meter by 10-meter) plot on the side of a canyon near a rock outcropping
- Two 13-foot by 13-foot (4-meter by 4-meter) plots across a creek bed from each other
- A 98-foot by 16-foot (30-meter by 5-meter) strip on level ground
- A 13-foot by 13-foot (4-meter by 4-meter) plot among the saguaros
- A 7-foot by 7-foot (2-meter by 2-meter) spot on level ground
- An old airstrip

We marked each plot with ribbon to aid the pilot. We placed sampling cards inside each plot to determine the appli-

cation rate consistency and outside most plots to determine drift (figure 2).



Figure 2—This 13-foot by 13-foot (4-meter by 4-meter) plot is at the bottom of a canyon. Note the stakes running through the plot. Each stake has a sampling card attached to the top of it.

Equipment

We used two types of spot sprayer during this demonstration: a “spray ball” with a single spray nozzle (figure 3) and a “pyramid” with four spray nozzles (figure 4). We suspended each sprayer from the tank on the belly of the helicopter by a 50-foot (15-meter) cable.

We sprayed each plot with a mixture of water and Hi-Light (Becker Underwood) blue liquid dye. We didn’t use herbicide because this spraying was just a demonstration of the spraying system.



Figure 3—The spray ball used in this demonstration has a single nozzle and was built by Simplex Manufacturing of Portland, OR.



Figure 4—HMC Helicopter Services of Miami, FL, built the pyramid used in this demonstration. It has four nozzles.

Observations

The pilot obtained good accuracy with the spot sprayer. He could maneuver the sprayer from 3 feet to 5 feet (1 meter to 2 meters) above the ground if the terrain had few obstacles and relatively little slope. The smallest area sprayed was 7 feet (2 meters) in diameter.

Spray patterns on the sampling cards differed throughout each plot (figures 5 and 6). The difference in these spray

Figure 5—This figure shows a sampling card used to give an indication of the application rates in a plot.

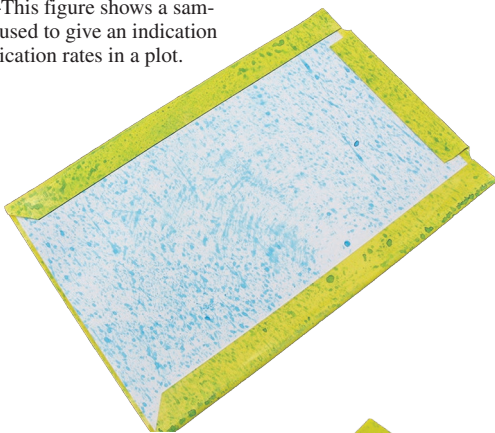
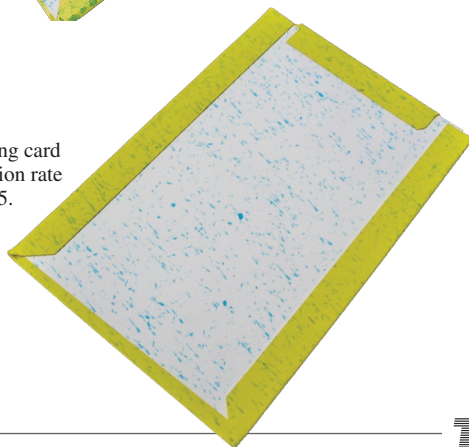


Figure 6—This sampling card shows a lower application rate than the card in figure 5.



patterns indicates that the application rates were inconsistent, but a consistent application rate may be difficult to obtain for two reasons:

- The motion of the sprayer at the end of the cable causes overlapping spray patterns.
- Maintaining a constant airspeed while spraying a small target area is difficult.

Because the pilot is alone in the aircraft during spraying, pretreatment Global Positioning System mapping of buffelgrass locations and a recon flight may be required for the pilot to navigate to the proper area.

Potential Advantages of Using the Spot Sprayer

Use of an aerial spot-sprayer system allows for the treatment of small areas or individual plants while causing less damage to nontargeted species than a conventional boom aerial-spraying system. The spot sprayer can reach infestations that are inaccessible to ground crews and requires less time than using backpack sprayers (figure 7). Use of the spot sprayer may reduce injuries to ground crews from falls and heat exhaustion.



Figure 7—Using the spot sprayer may allow for areas of rugged terrain to be treated more quickly and effectively than using backpack sprayers.

Potential Disadvantages of Using the Spot Sprayer

The effectiveness of the spot sprayer depends largely on a pilot's ability to maneuver a load at the end of a long line. In addition, the pilot must be licensed to apply herbicides. Because the sprayer must be placed low enough to the ground to reduce drift, it can potentially become caught in vegetation requiring the pilot to jettison the spray system.

The pilot must fly slowly and hover frequently at low altitude to obtain the precision necessary to make the spot sprayer effective. These flight conditions do not give the pilot much time to react in an emergency.

Many applications require flying over rugged terrain. If an emergency occurs when the aircraft is at low altitude over rugged terrain, it may not be possible for the pilot to reach a safe landing area. The cost to operate a helicopter combined with the need to treat relatively small target areas results in a high application cost per area.

Conclusions

An aerial spot-sprayer system can be useful to treat small areas or individual plants in difficult locations where it is desirable to minimize damage to nontargeted species.

The high cost of using a spot sprayer, however, may limit its use to small, high-value areas that are difficult to reach from the ground. This cost may be offset by reducing the amount of manpower needed to complete a job and by allowing treatment to be completed when it is most effective for invasive species control.



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Wesley Throop has been a project engineer at the Missoula Technology and Development Center since 1999. He previously worked at the Idaho National Laboratory's Advanced Test Reactor and on shipboard weapon-handling systems at the Puget Sound Naval Shipyard.

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Library Card

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Aerial spraying can be an effective way to contain noxious or invasive plant species. Aerial spraying using a conventional boom system can be problematic because the spray is not limited to a target species and spray can drift outside the target area. An aerial spot-sprayer system may help reduce these problems. This tech tip describes the demonstration by an interagency team of two types of spot sprayer.

Keywords: aerial spraying, herbicides, invasive species, noxious weeds, remote locations, safety at work, spot spraying, weeds



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